Making war on waste

Photos: Neill McKee

The world population increase is posing an unparalleled food dilemma for the 21st century. Yet every year millions of tons of fish that could provide protein for people, is being ground up to feed livestock in the industrialized countries, or, worse still, is simply thrown away. In the following article W.H. Allsopp, Associate Director, Fisheries, with the Centre's Agriculture, Food and Nutrition Sciences Division, explains how and why such waste occurs, examines some of the moral and political issues involved, and presents some practical solutions.

Until recently the conventional wisdom in many developing countries has been that the quickest and easiest way to develop a fishing industry is through fish meal production and other export products like shrimp, lobster and tuna. Inflation, the portents of the ongoing Law of the Sea Conference, and improvements in processing technology, however, have combined to bring a gradual change in policy that emphasizes the need for domestic self-sufficiency in food, and recognizes the value of fish products as an important source of protein.

One example of wasted fish resources is the shrimp trawling by-catch of fish. Wherever the outflow of large tropical rivers enriches the bottom feed organisms on a broad continental shelf outspread, the occurrence of large shrimp — sometimes called prawns — has given rise to shrimp trawling enterprises. For over 30 years such shrimp fisheries have been exploited by the "Gulf of Mexico" type of shrimp trawlers, which are mainly owned by American and Japanese companies. However, large quantities of fish are caught incidentally in the trawling operation, and this "by-catch" is usually discarded at sea, or in a few cases is converted to animal feed.

International shrimp trawling companies now fish in the Gulf of Mexico, and off the coasts of South America, East and West Africa, India and Southeast Asia. It has been estimated that the fish by-catch may total an annual average of at least 5 million tons of fish jettisoned in the tropical seas of the world, while 1 million tons of shrimp are landed worldwide.

Shrimp, not fish

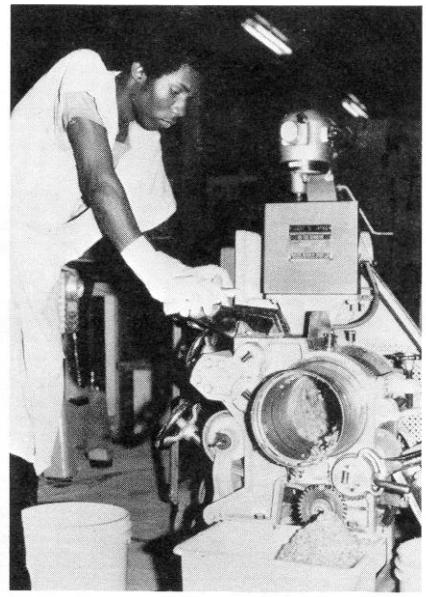
Because it is difficult to accept that such fantastic waste occurs, the complexity of the problem should be clearly explained. The vessels are designed with a refrigerated hold capacity of 15 to 30 tons of shrimp. They have a crew of three to five, are highly powered (450 hp engines) and costly to operate. The capital cost of such vessels varies from US $150,000 to $250,000 with operating costs and crew payments depending on catch, efficiency and location. Shrimp trawlers operating off Guyana, for example, generally gross annual earnings equivalent to the initial investment on the vessel. This can be done (with resulting profits to owners and crew) only if the hold is filled with shrimp, not fish! Various factors such as temperature of the hold, crew size and time at sea, are designed exclusively for handling shrimp.

Further, the great bulk and variation of the fish that are caught make it impractical to accommodate the total by-catch with the present system. The value of this fish (about 10 cents/lb) compares adversely with the price of shrimp (at least $1/lb). The fish is therefore thrown overboard in its stunned condition. It is eaten then by sharks, gulls and scavengers.

The problem is not only economic, but also technological. In the tropical seas as many as 50 fish species may be caught in a trawl. They vary in size, chemical content (white or oily) and some may even be poisonous. The quantity of fish caught will vary with the place (bottom type, depth and currents), time of day (fish are generally more active in daylight than shrimp) and time of year (the rainy season causes outflows from distant estuaries that affects the availability of fish). As some species of fish become mature and gravid, the chemical composition of the flesh and even its palatability varies. Generally the weight of shrimp caught is between 10 and 30 percent of the total catch landed. This mixed bag of fish would be difficult to process without some sorting between oily and white fish types. However, the fishing operation is generally done at night, the crew is too small and there is too little time between the landing of the twin trawls.

From the point of view of operational efficiency only major quantities of acceptable market fish can be considered for collection aboard or easy processing ashore. Assessments along the Guyana shelf estimated that about 200,000 tons of edible fish, consisting of eight major white flesh types, could be obtained annually from the fleet of between 175 and 210 trawlers. Yet the countries of the

Sorting the fish by-catch aboard the shrimp trawler "Arasuka" (photo previous page) off the coast of Guyana.



Scientists ashore experiment with new processing techniques.

Caribbean import the equivalent of 150,000 tons of fresh fish annually!

Unacceptable waste

Such a waste of consumable fish is unacceptable, and solutions for its satisfactory use are being sought throughout the tropical world. These approaches are considering ways of handling the fish at sea, systems for collecting and transportation from shrimp trawlers, and the processing of a mixed bag of species.

The development of shrimp-fish separator trawls has shown promise. Alternatives include the use of detached floating cod-ends (nets), and refrigerated sea water (RSW) tanks on the decks of trawlers in which the day's catch can be held. Both systems require the retrieval of the catch by a collection vessel operating along with the shrimp trawling fleet. The vessels with RSW systems used by the Pacific herring fleet off British Columbia are considered sufficiently adaptable for the exercise. However, until the bulk handling of the by-catch is proven practical and efficient, industrial scale processing ashore will not be readily applicable, since the landed cost of the fish will be too high, even before processing, for low-income consumers, who are the target population.

To test the practicality of using this fish, the Guyanese government required each shrimp trawler coming to the Port of Georgetown to land its last few days by-catch. This totalled about 2,400 tons a year, however the sudden volume of fish brought into the market created problems in handling, processing, cold storage, sales and distribution. In a tropical country so large a volume of fish is not easy to handle unless an efficient industrial infra-structure already exists. The resultant fish spoilage and waste leads to a spirit of frustrating discouragement both for the shore handlers and for the fishermen.

Since early 1973 the IDRC has been supporting the Guyanese government's efforts to solve these problems. Experiments in processing the mixed bag of fish using deboning machines have provided an extruded flesh quite free of bones, scales and skin. The waste (comprising fish bones and skin) can be converted to fish meal, while the comminuted fish flesh is now a new raw-material. Tests have been conducted in the project to make dried, spiced or salted products which are stable at normal temperatures, and can be packaged in sealed plastic bags and sold at low cost.

Additionally the project plans to make products of higher market value. That portion of the catch that comprises fish of higher consumer demand is to be processed as fillets or specialty products. These are intended to contribute appreciably to defraying the processing costs, thus permitting the bulk preparation of lower-cost stable fish products that are within the reach of rural communities where refrigerated storage is not widely available.

Similar approaches

At an IDRC-sponsored workshop in Thailand in 1974 similar situations were described in Southeast Asia. Parallel approaches are being made through fish technology laboratories in India, Thailand and Indonesia to solve the problem of the waste of the by-catch. It was pointed out that without any increase in fishing effort, more than 1 million tons could be available from the by-catch of shrimp trawling in that region.

The often published figures of fish production and the gap in protein requirements of the tropical belt of the developing world emphasize the obligation to utilize such incidental catches of fish — *not* for fish meal to feed livestock or pets, but for direct human consumption.

While the world's fish production has increased from 33.3 million tons in 1958 to 66 million tons in 1973, doubling in 15 years, there has been a decline in direct consumption of fish from 84 percent of the landed catch to 60 percent, with a comparative rise in industrial processing (for fish meal etc.) from 16 percent to 40 percent.

This means that the current trend is to convert to fish meal, almost the equivalent quantity of fish (26.2 million tons) as was directly consumed by man 15 years ago (28 million tons). The agonizing corollary of this is that the increased catch converted into fish meal has come largely from the oceans adjacent to protein-deficient developing countries, and sold to feed the livestock of the affluent nations of the world — in North America, Europe and Asia.

There is concern among the traditionally powerful high-seas fishing nations that the Law of the Sea Conference will limit their fish production. The grave concern of the developing countries, however, is that mechanized fishing off their shores removes large quantities of fish, much of which is wasted, while the remainder goes to countries where there is no food or protein shortage. Such fishing benefits neither the people nor the economy of the coastal states, and with the ever-increasing costs of technology, manufactured goods, services and fuel, there is little hope that they can compete with the established fishing nations.

With the new focus on self-sufficiency in food in the developing world, a more humane perspective is required by the advanced technologies of the industrialized world. Such a perspective should lead to concerted efforts to prevent such unacceptable "waste" of the valuable by-catch from tropical shrimp trawling as a valuable source of food for man. □